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## A REVISION OF THE GENUS NEMOPHILA.<sup>1</sup>

HARLEY P. CHANDLER.

(WITH PLATES II-V)

THE North American genus *Nemophila* is represented by fourteen species and four varieties. Two species belong to the southern states, one primarily to the Rocky mountains, and the remainder to the Pacific slope, principally California.

It is one of the genera in which the tendency to variation is very strong, and this has been the source of much error and confusion in classification. Many of the common species were described by Europeans who were innocent of field experience on the Pacific coast, and this quite naturally resulted in mistakes. The types of these species have not been easily accessible to American botanists and confusion has been worse confounded by their diverse interpretations of the meager published descriptions.

The present paper was undertaken in the hope first of clarifying the synonymy. To this end original descriptions have been freely consulted, some forty type specimens have been examined, and drawings of two types have been obtained from Europe. Exhaustive lists of acknowledged synonyms have not been introduced, but all disputed names and those of recent publication have received attention. The second and more important hope of the writer was to contribute something to our knowledge of the plants themselves, by a study of their variations in the field, as well as in the herbarium. The best way of expressing both classes of results seemed to lie in a revision of the genus.

Discussions of the various characters available for discriminating forms will be found in the remarks following the descriptions of certain species. Here it will suffice to say that the

<sup>1</sup> Contributions from the Botanical Laboratories of the University of California.

almost infinite variation makes an accurate limitation of species absolutely impossible; and most of the species as here described include a great variety of more or less inconstant forms. Were these all described they would fill a volume, but nothing would be gained thereby. Convenience should be the aim of classification, and this aim is most effectually defeated by the multiplication of uncertain species.

To avoid possible uncertainty in interpreting the descriptions, it should be said that measurements of leaves are given as including the petiole; but the outlines as including only the blade, except where there is a conspicuously tapering base.

The question of the relation of *Nemophila* to *Ellisia* is vital, but must be left for future consideration.

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#### KEY TO THE SPECIES.

Flowers 1<sup>cm</sup> or more across (except no. 2).

Leaves (at least the upper) alternate; seeds less than 5.

Angles of stems and often veins of leaves beneath retrorsely prickly.

Petioles broadly winged and auriculate-clasping; flowers 1 to 3<sup>cm</sup>  
across - - - - - 1. *N. aurita*

Petioles not winged nor auriculate-clasping; flowers less than 1<sup>cm</sup>  
across - - - - - 2. *N. racemosa*

Angles of stems not prickly.

Branches 2 to 6<sup>dm</sup> long; all but the earliest leaves alternate; corolla  
1 to 3<sup>cm</sup> across, blue - - - - - 3. *N. phacelioides*

Branches 0.5 to 2<sup>dm</sup> long; only the upper leaves alternate; corolla 1 to  
2<sup>cm</sup> across, violet with whitish green-spotted center - 4. *N. Kirtleyi*

Leaves mostly opposite; seeds usually 5 or more.

Corolla white with a dark purple spot at the tip of each lobe; scales  
oblong, half free, rolled toward the filaments - 5. *N. maculata*

Corolla blue or white without a spot at the tip of each lobe.

Corolla deep or pale blue, often veined with deeper blue and dotted  
toward the center; scales mostly broad, wholly adherent or free at  
the tip; cotyledons spatulate - - - - 7. *N. Menziesii*

Corolla white or pale blue.

Cotyledons spatulate; corolla-scales linear, wholly adherent.

8. *N. Menziesii atomaria*

Cotyledons with orbicular or oval blade; corolla-scales oblong or  
linear, part free - - - - 9. *N. Menziesii integrifolia*

Flowers 1<sup>cm</sup> or less across.

Corolla tubular or tubular-campanulate.

Corolla equaling or longer than the calyx.

Leaves opposite; seeds more than 1; Pacific coast.

Leaves oblong (rarely ovate) in outline, pinnately 5 to 7-lobed;  
corolla-scales linear, often reduced to hairy lines; seeds 2 to 12  
(mostly 6 or 8) - - - - 11. *N. pedunculata*

Leaves spatulate in outline, 3 to 5-toothed or -lobed at the tip, with  
cuneate base; corolla-scales small and lacinate, or obsolete.

12. *N. spatulata*

Leaves mostly ovate in outline, pinnately about 5-lobed, the upper  
3 lobes confluent; corolla-scales minute, various.

Plant hispid; lobes of leaves usually sharp; peduncles mostly  
shorter than the leaves; Washington to the Coast ranges of  
California - - - - 13. *N. parviflora*

Plant with softer, spreading pubescence; lobes of leaves more  
rounded, the lower sinuses shallower; peduncles mostly exceed-  
ing the leaves; foothills of the southern Sierra Nevada.

14. *N. parviflora quercifolia*

Leaves alternate, mostly triangular-ovate, 3 to 5-lobed; seeds mostly  
1 or 2; southern U. S. - - - - 15. *N. microcalyx*

Corolla mostly shorter than the calyx; leaves mostly alternate; seeds 1.  
16. *N. breviflora*

Corolla open-campanulate or pelviform.

Leaves opposite, oblong in outline, with 5 to 7 oblong lobes pinnately  
arranged; corolla mostly open-campanulate, not hairy within; scales  
linear, often reduced to hairy lines - - - - 10. *N. sepulta*

Leaves opposite, spatulate, elliptical or lanceolate in outline, shallowly 3 to 5-lobed at the tip or entire; corolla mostly open-campanulate, often hairy at the center; scales oblong to linear, often half free, or reduced to hairy lines - - - - - 6. *N. humilis*

Leaves, especially the upper, sometimes alternate, typically with 5 to 9 suborbicular petiolulate pinnately arranged lobes, but very diverse; corolla mostly pelviform, not hairy within.

Calyx-appendages evident; corolla white or bluish; scales various.

17. *N. exilis*

Calyx-appendages minute or obsolete; corolla usually deep blue; scales linear, ciliate - - - - - 18. *N. exilis pulchella*

1. *N. AURITA* Lindl., Bot. Reg. *t.* 1601. 1833.—Plant weak and straggling, leaning on other plants for support: branches 2 to 6<sup>dm</sup> long, hirsute, angled or winged, the angles armed with sharp prickles which aid in climbing: cotyledons not seen: leaves all but the lower alternate, 5 to 15<sup>cm</sup> long, more or less deeply pinnatifid into mostly 7 to 13 entire or shallowly lobed downward-pointing divisions; retrorsely barbed along the principal veins beneath; petioles winged, expanded below into an auriculate-clasping base: flowers mostly in very loose naked racemes at the tips of the branches: calyx-lobes lanceolate, 4 to 10<sup>mm</sup> long; appendages usually less than a third as long, spreading: corolla with a short throat constricted below the top and spreading limb 1 to 3<sup>cm</sup> across, violet, paler outside; scales triangular, usually fimbriate, below covering the base of the stamens, above turning away from them, often 3<sup>mm</sup> long: nectaries prominent, one between each pair of scales: style 2 or 3 times as long as the ovary, cleft only at the tip: capsule globular, 5 to 9<sup>mm</sup> in diameter, thin-walled: seeds 4 per capsule, globular, 1.25 to 3<sup>mm</sup> in diameter, conspicuously favose-reticulated; caruncle none (?).

The whole plant is prickly, sometimes even to the calyx.

CALIFORNIA AND ARIZONA.

*Specimens examined*: CALIFORNIA: Plumas co., *Mrs. Austin*; Stockton, *Sanford* no. 188; Kaweah river basin, *Hopping* no. 41, *Woolsey*; Bear creek, Tulare co., *Purpus* no. 1298; Kernville, *Brandeggee*; Niles, *Hall* no. 1648; Palo Alto, *Dudley*; Bixby creek, Monterey co., *Brandeggee*; Monterey co., *McLean*, *Plaskett*; San Luis Obispo, *Lemmon*; Dos Pueblos,

Santa Barbara co., *Brewer* no. 396; Casitas pass, Ventura co., *Hall* no. 3136; Santa Cruz island, *Brandegee*; Fort Mojave, *Lemmon*; Los Angeles, *Hasse*; Santa Monica cañon, *Barber* no. 53; Fallbrook, San Diego co., *Hall* no. 515; Del Mar, San Diego co., *Brandegee*.

ARIZONA: Diamond creek cañon, *Norman C. Wilson*.

The type was probably raised from seed sent by Douglas, who collected principally at San Francisco and Monterey, and is most likely in the herbarium at Kew or at the British Museum.

2. *N. RACEMOSA* Nutt., in Gray Proc. Am. Acad. 10: 315. 1875.—Near *N. aurita*, but less prickly: cotyledons with orbicular blade and long petiole: the leaves shorter and broader in outline and with fewer divisions, these more often toothed or lobed; petioles never broadly winged nor auriculate-clasping: flowers less than 1<sup>cm</sup> across, more plainly racemose: corolla-scales narrow, often half free, sometimes obsolete.

SOUTHERN AND LOWER CALIFORNIA.

*Specimens examined*: CALIFORNIA: Santa Cruz island, *Brandegee*; San Clemente island, *Nevin & Lyon*; Cajon heights, San Diego co., *Eastwood*; Del Mar, San Diego co., *Brandegee*; San Diego, *Alderson* no. 1007, *Brandegee*, *Setchell*.

LOWER CALIFORNIA: Guadalupe island, *Anthony* no. 254, *Brandegee*, *Francheschi* no. 32, *Greene*; Cedros island, *Brandegee*; San Martin island, *Anthony* no. 229, *Brandegee*; Estaban, *Brandegee*.

Type locality, "California; San Diego, Nuttall. Island of Catalina, Dall & Baker."

3. *N. PHACELIOIDES* Nutt., Jour. Acad. Philad. 2: 179. 1822.—Plant weak: branches 2 to 6<sup>dm</sup> long, spreading- or retrorse-hirsute: cotyledons not seen: all but the earliest leaves alternate, pinnately divided into 3 to 9 oblong, oval, or obovate, 2 to 5-cleft divisions, the upper three divisions confluent, the others often distant: lower flowers terminal (though apparently axillary), the upper loosely racemose: calyx-lobes lanceolate or oblong, 5 to 10<sup>mm</sup> long; appendages ovate or oblong, about half as long, not reflexed: corolla pelviform, 1 to 3<sup>cm</sup> across, blue; scales broad, sometimes part free, fimbriate: style twice as long as the ovary, cleft for a third its length: capsule about 5 to 9<sup>mm</sup> in diameter: seeds 4 per capsule, "obscurely compressed-punctate," according to Gray.

Only very scanty material of this species was accessible.

ARKANSAS AND TEXAS.

*Specimen examined*: TEXAS: Waco, Miss S. A. Trimble.

Type locality, Arkansas.

4. *N. KIRTLEYI* Henderson, Bull. Torr. Bot. Club **27**: 350. 1900.—Plant weak, diffuse: stems 5 to 20<sup>cm</sup> long, often purplish, hispid with spreading or retrorse hairs: cotyledons spatulate: upper leaves alternate, lower ones opposite, all triangular-ovate in outline, pinnately parted into usually five oblong or ovate, entire or 1 or 2-toothed divisions: peduncles exceeding the leaves: calyx-lobes lanceolate, 4 to 8<sup>mm</sup> long, enlarging in fruit, minutely pubescent and long-ciliate; appendages lanceolate to ovate, a third as long or less: corolla pelviform, little exceeding the calyx, 1 to 2<sup>cm</sup> across, "with violet border and whitish center, conspicuously green-spotted near the junction with the stamens;" scales broad, trapeziform, strongly fimbriate on the free edge: style nearly twice as long as the ovary, cleft for a third of its length: capsule globular or slightly elongated, 4 to 7<sup>mm</sup> in diameter: seeds 2 to 4 per capsule, ovoid, 2 to 3<sup>mm</sup> long, deeply pitted, the pits covered with deciduous scales; caruncle cap-like, evanescent.

IDAHO AND EASTERN OREGON. May be looked for in northeastern California.

*Specimens examined*: IDAHO: Florence, *Henderson* no. 3082 (co-type).

OREGON: Pine creek, *Cusick*.

The type locality is Salmon river hill, beyond Florence, Idaho county, Idaho, and the type specimen is in the National Herbarium.

5. *N. MACULATA* Benth., Jour. Hort. Soc. Lond. **3**: 319. 1848.—Branches ascending or decumbent, 10 to 30<sup>cm</sup> or more long, from almost glabrous to strongly hispid: cotyledons spatulate: leaves opposite, the lower 3 to 5<sup>cm</sup> or more long, pinnately parted into 5 to 9 ovate or sub-orbicular, mostly 1 to 3-lobed divisions; the upper shorter, usually with but 3 or 5 entire lobes at the tip and a cuneately tapering base, or lanceolate and entire: peduncles surpassing the leaves: calyx-lobes oblong-lanceolate to ovate, 4 to 10<sup>mm</sup> long; appendages lanceolate to linear, one fourth to one half as long, reflexed: corolla pelviform, 1 to 4<sup>cm</sup> across,

much exceeding the calyx, white with a dark purple spot at the tip of each lobe and rows of purple dots radiating from the center; scales oblong to oblong-linear, half free, mostly rolled toward the filaments, ciliate, 2 to 3<sup>mm</sup> long: style cleft about a third its length, 2 or 3 times as long as the ovary: capsule globular, 3 to 10<sup>mm</sup> in diameter: seeds usually 5 to 12 per capsule, globular or slightly elongated, 1.5 to 3<sup>mm</sup> long, sparingly pitted, scaly.

This *Nemophila* shows three types of leaf and they are not infrequently all found on one plant. The lowest leaves are deeply pinnate, resembling those of *N. Menziesii*; the next are shallowly lobed at the very tip, and have a long cuneate base; while those at the ends of the branches are often lanceolate and entire. The second form is the most common and characteristic. Depauperate specimens are not rare. The original collector called the plant *Nemophila speciosa*, but this name was not published with a description.

SIERRA NEVADA MOUNTAINS, MOSTLY BETWEEN 2,000 AND 5,000 FEET ALTITUDE.

*Specimens examined*: CALIFORNIA: Forbestown, Butte co., *E. Brooks*; Penn valley, Nevada co., *Jepson*; Placer co., *Bolander* nos. 4551 and 4566; Rose springs, El Dorado co., *M. H. Gates*; Clinton, Amador co., *Hansen* no. 88; Calaveras Big Trees, *Brewer* no. 2098, *Brandeggee, Greene*; Pine ridge, Fresno co., *Hall & Chandler* no. 167; Kaweah river basin, *R. Hopping* no. 138; Mineral King and Coburn mills, Tulare co., *Brandeggee*; Tulare co., *Purpus* nos. 1732, 3059, and 5706.

The type was raised in England from seed collected by Mr. Hartweg on an excursion "along the right bank of the Chuba [Yuba] river to the mountains [Sierra Nevada]." It is probably in the herbarium at the Royal Gardens, Kew.

6. *N. HUMILIS* Eastwood, Bull. Torr. Bot. Club 28: 150. 1901.—*N. Congdoni* Eastwood, l. c. 151.—In vegetative characters resembling *N. maculata*: leaves spatulate, elliptical, or lanceolate in outline, like the middle and upper leaves of that species: peduncles about as long as the leaves: calyx-lobes only 2 to 5<sup>mm</sup> long; the appendages a third as long: corolla open-campanulate, 5 to 10<sup>mm</sup> across, without a purple spot at tip of each lobe, but often with purple dots toward the center; scales from broad, lacinate and often half free to mere hairy lines which are often obscured by a mass of loose hairs at the center of the corolla: style once to twice as long as the ovary.



The available material of this species is unsatisfactory and it needs study in the field. Its affinity seems to be closest with *N. maculata*, from which it is readily distinguished by its smaller flowers, destitute of the purple spot at the tip of each corolla-lobe. It inhabits higher altitudes than that species.

SIERRA NEVADA MOUNTAINS FROM MARIPOSA COUNTY NORTHWARD.

*Specimens examined*: CALIFORNIA: Emigrant gap, Placer co., *M. E. Jones*; Summit, Placer co., *Eastwood* (type); Deer Park inn, Placer co., *C. J. Fox, Jr.*; Tioga road and Hetchy Hetchy road, Tuolumne co., *Congdon*; Hogan mt. and Konitz's place, Mariposa co., *Congdon*.

Type in the herbarium of the California Academy of Sciences, San Francisco, collected "on the trail between Summit and Summit Soda springs, in Placer county, June 9, 1898," by Miss Alice Eastwood, who states that it grew on a bank where the ground was still wet from the recently melted snow.

*N. MENZIESII* H. & A., Bot. Beech. Voy. 152. 1833, not of Syn. Fl., Bot. Cal., etc.—*N. insignis* Benth., Trans. Hort. Soc. n. s. 1:479. 1835. *N. liniflora* F. & M., Sert. Petrop. fol. & t. 8. 1846. *N. heterophylla* F. & M., l. c. *N. modesta* Kellogg, Proc. Cal. Acad. 7:93. 1877. *N. intermedia* Bioletti, Erythea 3:141. 1895. *N. Brandegei* Eastwood, Bull. Torr. Bot. Club 29:471. 1902. *N. macrocarpa*, Eastwood, l. c.—Branches slender or stout and succulent, ascending, mostly 10 to 25<sup>cm</sup> long, more or less hirsute-pubescent with spreading or appressed, not always retrorse hairs: cotyledons usually spatulate: leaves mostly opposite, the lower 4 to 9<sup>cm</sup> long, pinnately divided into 5 to 9 oblong, ovate, or suborbicular, mostly 2 or 3-lobed or -toothed divisions; upper leaves reduced and less divided in proportion to their distance from the root: peduncles slender, spreading, usually twice as long as the leaves: calyx-lobes lanceolate or ovate-lanceolate, 4 to 10<sup>mm</sup> long; appendages lanceolate to linear, half as long or less: corolla pelviform, divided about three-fourths the way to the base, 1 to 3.5<sup>cm</sup> across, from light to deep blue, veined deeper blue or purple, lighter-colored and often dotted, but seldom hairy toward the center; scales varying from broad and wholly adherent to narrow and part free, laciniate, ciliate or entire, often crisped: style 2 to 4 times as long as the ovary, parted for about a third its length: capsule elongated-globular, 5 to 10<sup>mm</sup> in diameter: seeds 5 to 25 per capsule, 1 to 2<sup>mm</sup> long, oblong-

ovoid or globose, scaly, rough, with a few deep pits; caruncle stipe- or cap-like.

Commonly called "baby blue eyes." Like all other *Nemophilas*, this species is exceedingly variable and sufficient allowance has not been made for the fact by some authors. It is particularly susceptible to moisture conditions. Where the soil is wet we find a succulent plant with sparse pubescence; where it is merely damp these characters are less pronounced; and where it is very dry the other extreme is reached — a very slender plant with dense pubescence. The variations in color are also striking (see note to the variety *atomaria*). Near the foggy coast of northern and central California the flowers are pale blue, usually dotted toward the center; in the Sacramento and San Joaquin valleys and in the sunny south coast ranges a deeper color predominates; while in southern California, which is practically desert except where reclaimed by man, a still more intense color is found. This is in accord with the common observation that in deserts flowers are brighter than in moister, less sunny regions; and since there are no accompanying variations which are at all striking, there seems to be sufficient reason for regarding as one species what a lay observer might distinguish as several different forms.

While mostly hermaphrodite, flowers with sterile anthers are occasionally found. They are smaller and deeper-colored than the others and according to Miss Alice Eastwood<sup>2</sup> they are associated with a more robust habit in the plant. Her investigations indicate that there is no marked difference in the seed-producing qualities of the two sorts of flowers.

There has been much confusion in the application of the specific names *Menziesii* and *insignis*, and the writer has investigated the matter with some care. The *Botany of Beechey's Voyage* was issued in parts. Page 152, on which the description of *N. Menziesii* appeared, is in Part 4, issued in 1833,<sup>3</sup> two years before the publication of *N. insignis*. On page 372 (Part 8, 1840) an expanded description is given and two forms, *a* and *β*, are noted: "*a. corolla calycem vix duplo superante*" is stated to be the form described on page 152; "*β. corolla calycem plus duplo superante*" is given as equivalent to *N. insignis*, which had been published in the time between the issuance of pages 152 and 372. Hooker and Arnott, then, who were co-workers with Bentham and probably had seen the type *N. insignis*, found nothing to distinguish that species from *N. Menziesii* except a slight difference in the relative size of corolla and calyx, a character in which the field student of these plants cannot but recognize considerable variation. Indeed, Hooker once declared that *N. insignis* ought to be called *N. Menziesii*.<sup>4</sup>

<sup>2</sup> Erythea 3 : 152.

<sup>3</sup> See Jackson, in Journal of Botany 31 : 298.

<sup>4</sup> Bot. Mag. t. 3774.

As for the original descriptions, each easily includes the other. The only possible remaining ground for separating the two species lies in the fact that Hooker and Arnott describe their plant as having leaves precisely like those of *N. parviflora*. There is no large-flowered species which has leaves of that style except *N. phacelioides*, with which they were well acquainted and which does not grow in the same part of the continent as *N. Menziesii*. Moreover, had the leaves been essentially different from those of *N. insignis*, Hooker and Arnott would surely have made note of the fact in contrasting forms  $\alpha$  and  $\beta$ .

These considerations seem to the author to establish the identity of *N. insignis* with *N. Menziesii*, and the priority of the latter name.

Dr. Fischer de Waldheim kindly sent to the Herbarium of the University of California a flowering branch from the type specimen of *N. heterophylla*. An examination of this and a consideration of the original description (which, by the way, it contradicts in having the upper leaves always opposite and never sessile) show that it is one of the countless forms of *N. Menziesii* (not of *N. parviflora*, as Gray and others have thought). *N. liniflora* is another of these forms. Had Fischer and Meyer themselves collected in California, they would have known better how to allow for variation in *Nemophila*.

In the expanded description of *N. Menziesii* referred to above, we find "corollae (caeruleae parce nigro-punctatae) . . ." If the corolla is dotted, it is probable that the type is the form most common in the north coast ranges of California, namely, that which Mr. Bioletti has separated as *N. intermedia*. But such a consideration aside, *N. intermedia* is not a good species (see above and note to *N. Menziesii* var. *atomaria*).

THROUGHOUT CALIFORNIA, EXCEPT IN THE NORTH AND THE HIGH MOUNTAINS.

*Specimens examined:* CALIFORNIA: Ukiah, *Purdy*; Mendocino co., *Chandler*; Ft. Ross, *Davy* no. 1673; Adobe cañon, Sonoma co., *Michener & Bioletti*; Santa Rosa cañon and Kenwood, Sonoma co., *M. S. Baker*; Vacaville, *Jepson, Platt*; Mt. Tamalpais, *Chandler* no. 281; Angel island, San Francisco bay, *Michener & Bioletti*; Oakland, *Brewer* no. 2764, *Holder* no. 2520; Berkeley, fresh material; Briones hills, Contra Costa co., *Chandler* no. 595; Bryants, Contra Costa co., *Chandler* no. 575; Moraga valley, Contra Costa co., *Hall* no. 1624; Mt. Diablo, *Chandler* no. 970; San Francisco, *Chandler, Davy* no. 2975, *Jepson*, etc.; Palo Alto, *Dudley*; Tres Pinos, *Dudley*; Pajaro hills, Monterey co., *Chandler* no. 410; Monterey, *Plaskett*; Pacific Grove, *Chandler*; San Luis Obispo co., *Brewer* no. 406, *Mabel M. Miles* no. 146; Santa Barbara, *Brandegee*; Santa Susanna mts., *Brewer* no. 216; Leonis valley, *Davy* no. 2610; Claremont, *Martha Allen, Chandler*; San Bernardino, *Parish* no. 25, *Setchell*; Gavilan, Riverside co., *Hall* no. 2931; Winchester, *Hall*; Temescal mts., *Hall* no. 406; San Jacinto, *Mrs. Gregory*; San Jacinto mts., *Hall*; Temecula, *Cleveland*; Banner, *Brandegee*;

Santa Ysabel, *Alderson*; San Felipe, *Brandegee*; Rosedale, *Abrams*; Lerdo, *Brandegee*; Tulare, *Davy* no. 3102; Kaweah, *R. Hopping* no. 166; Grapevine spring, Tulare co., *Woolsey*; Alcalde, *Brandegee*; Fresno, *Buckminster*; Yosemite, *Dodd*; Rose springs, El Dorado co., *M. H. Gates*; Sacramento, *M. S. Baker*; Penn valley, Nevada co., *Jepson*; Sutter co., *Jepson*; Chico, *Winifred Paine*; "California," *Thomas Bridges*, no. 170.

The type was collected in California by the botanists of the Beechey Voyage, all of whose collecting was done at San Francisco and Monterey. It is in the herbarium at the Royal Botanic Garden, Kew, and is said to have no flowers.<sup>5</sup>

8. *N. MENZIESII atomaria* (F. & M.) Chandler, comb. nov.—*N. atomaria* F. & M., Ind. Sem. Hort. Petrop. 2:42. 1835. *N. Menziesii* of Bot. Cal., Syn. Fl., etc., not of H. & A. *N. insignis atomaria* (F. & M.) Jepson, Fl. West. Mid. Cal. 434. 1901. *N. venosa* Jepson l. c. (a garden escape). *N. Johnsoni* Eastwood, Bull. Torr. Bot. Club 29:472. 1902.—More succulent and less pubescent than the type, often nearly glabrous: calyx-lobes shorter and broader: corolla rather smaller, somewhat more deeply divided, white or pale blue, dotted or rarely only veined dark blue-purple or black, hairy at the center; scales very narrow, usually hairy, scarcely or not at all enlarged or free at the tip, often reduced to a mere line of hairs.

Some authors find the style more deeply divided than in the type.

This variety intergrades with the type in every character and the variations are not always concomitant, so that there are frequently specimens (*e. g.*, *Chandler* no. 1276, Humboldt co., Cal.) which may be referred almost equally well to either. Plants which in every other respect answer to var. *atomaria* (*e. g.* *Michener* & *Bioletti*, Sonoma, Cal.) have scales broader than is usual even in the type; while others which are plainly *N. Menziesii* (*e. g.*, *Plaskett*, Monterey, Cal.) have the scales reduced to a mere line of hairs. Between these extremes there is every variation.

In a series of a half dozen living specimens from Kenwood, Cal., *M. S. Baker*, there were several instructive series. In color and marking of corolla three distinct steps were observed on as many plants: *A*, flowers white, dotted with blue to the edge; *B*, flowers slightly bluish, veined deeper blue, dotted toward the center; *C*, flowers bright blue, veined darker blue, white (but not dotted) at center. In the matter of succulence, a series of three plants showed a decided increase of pubescence and an approximately corresponding decrease of succulence as the type was approached. The shape of the calyx-lobes varied less uniformly.

<sup>5</sup> Bioletti, *Erythea* 3: 140.

A species is probably now being evolved in the direction of greater succulence, less pubescence, smaller and lighter-colored flowers, shorter calyx-lobes and narrower corolla-scales; but on account of the complete intergradations and the frequent lack of concomitance in variation, it seems best to retain the form as a variety. For this same reason *N. intermedia*, which lies between *N. Menziesii* and the variety, is excluded.

Most of the variegated garden *Nemophilas* should probably be referred to this variety.

COAST RANGES OF CALIFORNIA, IN MOIST PLACES.

*Specimens examined*: OREGON: Elk Head, Douglas co., *Howell*.

CALIFORNIA: Smith river, Del Norte co., *P. E. Goddard*; Hupa, Humboldt co., *Chandler, Davy & Blasdale* no. 5739, *Mrs. Manning*; Ukiah, *Purdy*; Round valley, Mendocino co., *Westerman*; Napa river basin, *Jepson*; Yountville, *Jepson*; Sonoma, *Michener & Bioletti*; Kenwood, *M. S. Baker*; Cloverdale, *Setchell*; Point Reyes, *Davy* no. 1684, *Eastwood*; Olema, *Davy* no. 681; Fairfax, *Michener & Bioletti*; Mt. Tamalpais, *Chandler* no. 485, *Jepson*; San Francisco, *Chandler*, etc.; San Mateo co., *Tidestrom*; Loma Prieta mt., *Davy* nos. 441, 541, and 604; Alma, Santa Cruz co., *Brandegge*; Glenwood, Santa Cruz co., *Michener & Bioletti*.

The type locality is "circa coloniam Röss in Nova California," near the present town of Fort Ross. The type specimen is doubtless in the herbarium of the Imperial Botanic Garden at St. Petersburg.

9. *N. MENZIESII* INTEGRIFOLIA Parish, *Erythea* 6:91. 1898.—*N. rotata* Eastwood, Bull. Torr. Bot. Club 28:159. 1901. excl. pl. *Orcutt*.—Plants slender, often prostrate: cotyledons with orbicular or oval blade: leaves usually (not always) somewhat less divided than in the type, sometimes even entire or with only a few lobes at the tip and a cuneately narrowing base: peduncles sometimes shorter than the leaves: flowers smaller than in the type: corolla pelviform to almost rotate, often only 1<sup>cm</sup> across, pale blue or white, veined blue, usually hairy and dotted with purple toward the center; scales oblong to linear, half free or attached by one of the narrow edges, variously hairy or lacinate.

The leaves of this variety are infinitely various and a great range of shapes is often found on the same plant. The scales are also various, but almost never wholly adherent; the most common form seems to be a linear scale which is attached for half its length, then turns outward at an obtuse angle and comes to a bristly acuminate point.

The var. *integrifolia* is a southern analogue of the var. *atomaria*, from which it differs chiefly in less succulent habit, greater pubescence, shape of

cotyledons, less divided leaves, peculiar corolla-scales, and geographical range. Where the ranges of the two varieties meet they intergrade (Leonis valley, *Davy*: Casitas pass, *Hall*).

Of the variety as described here, the type specimen is an extreme form, having mostly entire leaves.

SOUTHERN CALIFORNIA.

*Specimens examined*: CALIFORNIA: Elizabeth lake, Los Angeles co., *Hall* no. 3081; Antelope valley, *Davy*; Leonis valley, *Davy*; Pasadena, *M. E. Jones*; Santa Monica, *Barber*; Claremont, *Illingworth*, *Sanborn*; San Bernardino mts., *Hall*, *Parish* no. 4196; Palomar, *Hall* no. 1951; Ramona, *Brandegee*; San Jacinto mts., *Hall* no. 2266; Encinitas, El Volcan, and Point Loma, San Diego co., *Brandegee*; Witch creek, San Diego co., *Alderson*; Laguna woods, San Diego co., *Cleveland*; San Diego, *Eastwood* (type of *N. rotata*).

The type locality is Waterman cañon, San Bernardino mountains, and the type specimen is in the herbarium of S. B. Parish, at San Bernardino.

10. *N. SEPULTA* Parish, *Erythea* 7:93. 1899.—*N. Menziesii minutiflora* Suksdorf, *Deut. Bot. Monatsch.* 18:133. 1900. *N. densa* Howell, *Fl. N. W. Am.* 466. (Mch. 21) 1901. *N. nana* Eastwood, *Bull. Torr. Bot. Club* 28:151 (Mch 27) 1901. *N. exigua* Eastwood, *l. c.* 157. *N. alata*, Eastwood, *l. c.* 158.—Plant prostrate, or very rarely sub-erect: branches from mostly a few centimeters to 4<sup>dm</sup> long, sometimes winged, sparingly pubescent: cotyledons spatulate: leaves opposite, 2 to 5<sup>cm</sup> long, oblong in outline, pinnate into 5 to 7 mostly oblong, rarely toothed divisions: peduncles shorter or longer than the leaves, strongly deflexed in age and sometimes burying the capsules: calyx-lobes lanceolate, 2 to 5<sup>mm</sup> long; appendages from a third to three-fourths as long, spreading or reflexed: corolla open-campanulate, the lobes longer than the tube, 3 to 7<sup>mm</sup> across, white, often dotted with blue toward the center; scales linear or reduced to hairy lines: style from once to twice as long as the ovary, divided for a third or a half its length: capsule globose, 3 to 6<sup>mm</sup> in diameter: seeds usually about 4 per capsule, irregularly elongated-globose, 2 to 3<sup>mm</sup> long, coarsely pitted and minutely scabrous (when typical), scaly; the caruncle cap-like. *Plate I.*

This species is very close to the succeeding and also shows affinity with

*N. Menziesii*. Field study is needed with reference to the shape and markings of the corolla.

FROM WASHINGTON TO SOUTHERN CALIFORNIA.

*Specimens examined*: WASHINGTON: Clark co., *Suksdorf* no. 2315; Klickitat co., *Suksdorf* nos. 684 and 2198 (co-type of *N. Menziesii minutiflora*).

OREGON: Mosier, Wasco co., *Howell*; Oregon city, *Howell*; Mitchell, Crook co., *Howell*; Prineville, Crook co., *Leiberg* no. 250; Ouryhee, Malheur co., *Leiberg* no. 2180.

CALIFORNIA: Little Shasta, Siskiyou co., *F. W. Hooper*; Forestdale and Pine creek, Modoc co. *M. S. Baker*; Clear creek, Butte co., *Brown* no. 173 (type of *N. alata*); Mohawk valley, Plumas co., *Lemmon*; Sierra valley, Sierra co., *Lemmon*; Stony creek, Amador co., *Hansen* no. 1522 (type of *N. exigua*); Bartlett mt., Lake co., *Eastwood* (type of *N. nana*); San Bernardino mts., *Parish* nos. 1842, 3782 (co-type), and 4908.

The type locality is Bear valley, San Bernardino mts., California, and the type is in the herbarium of Mr. S. B. Parish, at San Bernardino.

11. *N. PEDUNCULATA* Dougl., in Benth. Trans. Linn. Soc. **17**: 275. 1837.—*N. humifusa* Kellogg, in Eastwood, Bull. Torr. Bot. Club **28**: 41. 1901. *N. Austinae* Eastwood, *l. c.* 143.—Plant prostrate, in open places spreading in dense mats, or among underbrush decidedly lax: branches mostly 5 to 30<sup>cm</sup> long, sparingly pubescent: cotyledons mostly with oval blade and narrow petiole: leaves opposite, 2 to 5<sup>cm</sup> long (in rare cases 8<sup>cm</sup> long), oblong (or rarely ovate) in outline, pinnate into 5 to 7 broad, usually toothed or lobed divisions: peduncles shorter (or sometimes longer) than the leaves, strongly deflexed in age and sometimes burying the capsules: calyx-lobes lanceolate, 1.5 to 4<sup>mm</sup> long; appendages narrower, usually less than half as long, spreading or reflexed: corolla tubular or tubular-campanulate, the lobes about as long as the tube, scarcely exceeding the calyx, 2 to 3<sup>mm</sup> across, white or pale blue; scales linear or reduced to hairy lines: style from once to twice as long as the ovary, divided for a third or a half its length: capsule globose, mostly 2 to 4<sup>mm</sup> in diameter: seeds 2 to 12 (mostly 6 to 8) per capsule, elongated-globose, 1.5 to 2.5<sup>mm</sup> long, coarsely pitted and minutely scabrous, scaly; caruncle cap-like, often having a narrow prolongation at one side. *Plate II*.

*N. Austinae* may prove distinct enough to become a variety. It is

marked chiefly by its often shallowly 5-lobed leaf, which is ovate in outline, and its few seeds (2 to 4 per capsule). The type came from Davis creek, Modoc county, California, *Mrs. Austin*, and specimens collected by the writer at Marble mountain, Siskiyou county, are similar. The form should be observed for other characters.

FROM WASHINGTON TO LOWER CALIFORNIA.

*Specimens examined*: WASHINGTON: Klickitat co., *Suksdorf* nos. 2637; 2638.

OREGON: Dalles city, *Suksdorf* no. 2639.

CALIFORNIA: Davis creek, Modoc co., *Austin* (type of *N. Austinae*); Marble mt., Siskiyou co., *Chandler* nos. 1649 and 1706; Susanville, Lassen co., *Brandeggee*; San Francisco, *Kellogg* (type of *N. humifusa*), *Chandler* no. 1800; Coyote creek, Santa Clara co., *Chandler* no. 929; Island of Santa Cruz, *Brandeggee*; Santa Inez mts., *Brandeggee*; Porterville, Tulare co., *Dudley*.

LOWER CALIFORNIA: Japa valley, *Orcutt* no. 1128, in part.

The type locality is the Columbia river and the type specimens are in the herbarium of the Royal Botanic Gardens at Kew.

12. *N. SPATULATA* Coville, Bot. Death valley. 156. 1893.—*N. inconspicua* Eastwood, Bull. Torr. Bot. Club 28: 144. 1901, not *N. inconspicua* Henderson. *N. pratensis* Eastwood, *ibid.* 29: 474. 1902.—Closely related to *N. pedunculata*, but differing in the following particulars: leaves spatulate in outline, 3 to 5-toothed or -lobed only at the tip, with long cuneate base: corolla often with a purple spot at the tip of each lobe and a few dots at the center; scales small and laciniate or obsolete: style sometimes scarcely evident: seeds fewer (mostly 3 or 4) per capsule; caruncle cap-like, without a prolongation at one side.

The type specimen is itself an intergrade and dangerously near *N. pedunculata*. At the other extreme the variation is toward *N. maculata*, which it approaches in leaves and corolla markings.

SOUTHERN SIERRA NEVADA AND SAN JACINTO MOUNTAIN, CALIFORNIA.

*Specimens examined*: CALIFORNIA: Sierra Nevada mts., Fresno co., *Hall & Chandler* nos. 104, 411 and 423; Bearskin meadow, South fork King's river, *Eastwood* (type of *N. inconspicua* Eastwood); Sierra Nevada mts., Tulare co., *Death valley expedition* nos. 1522 and 1671 (type); San Jacinto mt., *Hall* no 2406.

"Type specimen in the United States National Herbarium, no. 1671,



Death valley expedition; collected August 21, 1891, in Whitney meadows, Sierra Nevada, Tulare co., California, by Frederick V. Coville."

13. *N. PARVIFLORA* Dougl., in Benth. Trans. Linn. Soc. **17**: 275. 1837.—*N. inconspicua* Henderson, Bull. Torr. Bot. Club **27**: 349. 1900, not *N. inconspicua* Eastwood. *N. macrophylla* Eastwood, Bull. Torr. Bot. Club **28**: 144. 1901. *N. pustulata* Eastwood, *l. c.* 145. *N. micrantha* Eastwood, *l. c.* 146. *N. Kelloggii* Eastwood, *l. c.* 147. *N. Plaskettii*, Eastwood, *l. c.* 147.—Stems mostly weak, decumbent or ascending, 3 or 4<sup>cm</sup> to as many decimeters long, hispid: cotyledons with orbicular or oval blade and long slender petiole: leaves mostly opposite, 1 to 6<sup>cm</sup> long, various but typically ovate in outline, pinnately 5-lobed, the lobes toothed or lobed, the upper three often confluent, the lateral occasionally petiolulate: peduncles seldom as long as the leaves: calyx-lobes triangular or lanceolate, 1 to 4<sup>mm</sup> long; appendages less than half as long, lanceolate, spreading: corolla mostly tubular-campanulate, 2 to 5<sup>mm</sup> across, little exceeding the calyx, white or suffused with blue; scales minute, various but usually half free and ciliate or lacinate: style once to twice as long as the ovary, divided about half way: capsule globose, 3 to 5<sup>mm</sup> in diameter: seeds usually 4 per capsule, but varying from 2 to 5, irregularly globose, deeply pitted and minutely roughened, scaly; caruncle stipe-like. *Plate III.*

FROM IDAHO AND WASHINGTON THROUGH OREGON AND THE COAST RANGES OF CALIFORNIA.

*Specimens examined*: BRITISH COLUMBIA: Vancouver, *Macoun* (type of *N. pustulata*).

IDAHO: Soldier mt., *Henderson* (type of *N. inconspicua* Henderson).

WASHINGTON: Whidby island, Puget sound, *Gardner* no. 395; Nesqually, Puget sound, *Wilkes Exped.*, no. 90; Seattle, *Piper*; upper valley of the Nesqually, *Allen* no. 61; Klickitat co., *Suksdorf* no. 172; "Washington Territory," *Dr. Cooper*; "Washington," *Brandeggee*.

OREGON: Portland, *Henderson*, *Kellogg* & *Harford*; Polk co., *Spillman*; "Western Oregon," *Howell*; Sauvie's island, *Howell*.

CALIFORNIA: Sommes bar, Siskiyou co., *Chandler* no. 1537; Redwood creek, Humboldt co., *Chandler* no. 1270; Hydesville, Humboldt co., *Tracy*; Rowe's station, Mendocino co., *Chandler* no. 1037; Ukiah, *Purdy*; Mendocino, *Brown* no. 742; Inverness, Marin co., *Eastwood*; Mt. Tamalpais,

*Chandler* nos. 515, 769, etc., *Eastwood* (type of *N. micrantha*); San Mateo co., *Kellogg & Brannan*; Wrights, Santa Cruz co., *Brandegee*; Big basin, Santa Cruz mts., *Dudley*; Santa Cruz mts., *Kellogg & McLean* (type of *N. Kelloggii*); Santa Lucia mts., Monterey co., *Plaskett* no. 32 (type of *N. Plaskettii*); "California," *Vasey*.

The type locality is the Columbia river and the type specimen is in the herbarium at the Royal Gardens, Kew.

14. *N. PARVIFLORA quercifolia* (Eastwood) Chandler, comb. nov.—*N. quercifolia* Eastwood, Bull. Torr. Bot. Club 28:142. 1901.—Plant with softer, more spreading pubescence than the type: leaves with more rounded lobes and shallower sinuses, the lower of these scarcely deeper than the upper: peduncles mostly exceeding the leaves: calyx-lobes mostly oblong.

This variety is separated on what are usually rather unstable characters, but here they seem constant enough to warrant a separation, especially since the geographical range is quite remote from that of the type.

#### FOOTHILLS OF THE SOUTHERN SIERRA NEVADA.

*Specimens examined*: CALIFORNIA: Pine ridge, Fresno co., *Hall & Chandler* nos. 91 and 250; Sequoia mills, Fresno co., *Eastwood* (type); Kernville, *Brandegee*; Greenhorn mts., Kern co., *Palmer* no. 32; San Emidio cañon, Kern co., *Davy* no. 2070.

Type in the herbarium of the California Academy of Sciences, San Francisco; collected at Sequoia mills, Fresno co., by Alice Eastwood.

15. *N. MICROCALYX* (Nutt.) F. & M.—*Ellisia microcalyx* Nutt., Trans. Am. Phil. Soc. II. 5:191. 1833-7. *E. ranunculacea* Nutt., l. c. *Nemophila microcalyx* F. & M. Sert. Petrop. t. 8. 1846.—Near *N. parviflora*, but differing principally in the following particulars: leaves broader at the base, often only 3-parted, mostly alternate: peduncles shorter: corolla-scales often obsolete: seeds usually only 1 or 2 per capsule.

SOUTHERN UNITED STATES, FROM VIRGINIA AND FLORIDA WESTWARD TO ARKANSAS AND TEXAS.

*Specimens examined*: TENNESSEE: Knoxville, *Ruth*; Nashville, *A. H. Curtiss* no. 2125, *Gattinger*.

ARKANSAS: Little Rock, *Hasse*.

LOUISIANA: St. Martinsville, *Langlois*.

Type locality, "Arkansas, Alabama, etc."

16. *N. BREVIFLORA* Gray, Proc. Am. Acad. 10:315. 1875.—*N. parviflora* of Torr. in Wats. Bot. King Exp. 249, excl. char.—

Plant usually weak, though often fleshy: branches decumbent or ascending, 5 to 35<sup>cm</sup> long, sparingly hairy: cotyledons spatulate: leaves (all but the lowest) alternate, 2 to 5<sup>cm</sup> long, triangular-ovate in outline, deeply pinnately parted into mostly 5 oblong, falcate, entire or 1 or 2-toothed divisions: peduncles shorter than the leaves: calyx-lobes oblong- to linear-lanceolate, 2 to 5<sup>mm</sup> long in flower, enlarging greatly in fruit, nearly or quite glabrous except for the strongly ciliate margins; appendages proportionately broader, less than half as long, reflexed: corolla mostly tubular, not exceeding the calyx, about 2<sup>mm</sup> across, white or purplish; scales narrow, trapeziform, fimbriate: style scarcely longer than the ovary, cleft only at the tip: capsule globular, 3 to 5<sup>mm</sup> in diameter: seeds 1 per capsule, globular, 2 to 3.5<sup>mm</sup> in diameter, pitted and minutely roughened, scaly, often blood-red; caruncle cap-like (?), evanescent.

ROCKY MOUNTAINS FROM UTAH TO MONTANA AND WESTWARD TO WASHINGTON AND OREGON. Not yet found in California, but to be looked for in Modoc and Siskiyou counties.

*Specimens examined*: WASHINGTON: Yakima region, *Brandegee*; Falcon valley, *Suksdorf*; "Washington," *Vasey* no. 403.

OREGON: Blue mts., *Coville* no. 537, *Howell*; eastern Oregon, *Cusick*; Steins mts., *Leiberg* no. 2498.

MONTANA: Summit G. N. Ry., *Williams* no. 170; Bridger mts., *Rydberg & Bessey* no. 4860.

IDAHO: Coeur d'Alene mts., *Leiberg* no. 1062; Latah co., *Piper*; Craig mts., *Henderson* no. 2748.

WYOMING: Yellowstone park, *Nelson* no. 5566, *Tweedy* no. 405; Teton forest reservation, *Brandegee*.

UTAH: Bear river cañon, *Watson (King exped.)* no. 869 (type).

The type was collected at Bear river cañon, Utah, July, 1869, by Sereno Watson, as no. 869 of the Clarence King expedition, and was determined by Torrey (not by Watson, as Gray implies in his citations) as *N. parviflora*. It is in the United States National Herbarium.

17. *N. EXILIS* Eastwood, Bull. Torr. Bot. Club 28: 148. 1901. —*N. flaccida* Eastwood, *l. c.* 149. *N. inaequalis* Eastwood, *l. c.* 149. *N. hispida* Eastwood, *l. c.* 152. *N. divaricata* Eastwood, *l. c.* 153. *N. tenera* Eastwood, *l. c.* 153. *N. gracilis* Eastwood, *l. c.* 154. *N. nemorensis* Eastwood, *l. c.* 155. *N. glauca* East-

wood, *l. c.* 156. *N. fallax* Eastwood, *l. c.* 156. *N. diversifolia* Eastwood, *ibid.* 29:473. 1902. *N. decumbens* Eastwood, *l. c.*—Plants when growing in deep shade weak and only moderately hairy; in more open places usually more stout and hispid: branches from a few centimeters to 6<sup>dm</sup> long: cotyledons with orbicular or oval blade and slender petiole: leaves exceedingly diverse in form and size, 1 to 10<sup>cm</sup> long; the lower opposite, mostly pinnate with 5 to 9 suborbicular, often 2 or 3-lobed divisions on narrow petiolules; the upper often alternate, less divided, not rarely entire: peduncles slender, shorter or longer than the leaves, spreading: calyx-lobes from ovate- to linear-lanceolate, 1.5 to 5<sup>mm</sup> long; appendages proportionately broader, mostly less than a fourth as long, reflexed: corolla pelviform or broadly campanulate, 4 to 10<sup>mm</sup> across, white or bluish; scales various, semicircular, oblong or triangular, occasionally half free, entire or lacinate: style from 1 to 3 times as long as the ovary, parted for from a third to a half its length: capsule globular, 2 to 4<sup>mm</sup> in diameter: seeds 2 to 5 per capsule, elongated-globular, scrobiculate; caruncle cap- or stipe-like. *Plate IV.*

This species includes several forms which have long been classed with *N. parviflora*. It represents a larger range of variation than any other *Nemophila*, but these variations are nearly all directly referable to life relations. In view of the attempt which has recently been made<sup>6</sup> to define several species in this group, a discussion of the characters employed in discrimination of the forms seems worth while.

Habit, pubescence, and leaves do not afford satisfactory characters, for they all depend to a great extent on the life relations of the individual. For example, plants growing in deep shade tend to produce broad leaves and sparse pubescence, the degree of dissection of the leaves and the density of the pubescence being fairly accurate measures of the intensity of the light received; moisture very strongly increases the general thrift of the plant and diminishes the pubescence; competition prevents spreading and lengthens the internodes; so, too, soil, temperature, wind, and a dozen other factors have their influences. When we remember that not one, but all of these factors are operative on each plant, and when we realize that we are dealing with one of the most unstable of genera, we are constrained to put little faith in vegetative characters.

<sup>6</sup> EASTWOOD, Bull. Torr. Bot. Club 28:137 *et seq.*

Miss Eastwood has divided the small-flowered *Nemophilas* into eight groups based upon the shapes of the corolla. These distinctions are too fine. Such factors as age, the time of day, the degree of shade, or the amount of nourishment received by the individual plant may easily make great differences in the appearance of pressed flowers. For example, in the morning a plant may appear to have tubular flowers, while in the afternoon, when the light is more intense, the same flowers may open wider and become tubular-campanulate. If pressed in the morning condition, the flowers even when soaked up will appear tubular, and correspondingly for those pressed in the afternoon condition. As an instance of how dangerous such a close division on this line may be, witness that Miss Eastwood has placed *N. sepulta* in Section 1, "Corolla tubular, minute," when that species almost invariably has open-campanulate flowers.

The position of the corolla-scales is also unreliable. In the living flowers of most species the scales stand nearly perpendicular to the corolla; so their position in the pressed flower is accidental, or at most represents a very slight inclination from the perpendicular in the living flower. One frequently finds in the same flower some scales folded towards the stamens and others folded away from them; so that in most cases very little significance can be attached to their position.

The shape of the scales is also exceedingly diverse, apparently much more so than in the large-flowered species. Plants which agree in every other particular often show quite different scales, and there is sometimes considerable variety on one plant or even in one flower.

The writer has found no character which seems perfectly satisfactory for discriminating species. In so variable a genus as *Nemophila*, and more particularly in this most variable group, concomitance in variation should be demanded before a form is named; otherwise there is no limit to the number of species we may make and our classification will become a burden. Some of the species here reduced may prove to present such concomitance when they are better known; but at present the writer does not feel justified in maintaining them.

Unfortunately, the type specimen of *N. exilis* is not a typical form of the species as here described. The writer does not find the corollas of the type "distinctly salverform," and he inclines to the opinion that their approximation to that form is due to the flowers shriveling before being pressed. Flowers of even so open-flowered a species as *N. Menziesii* have been seen where this had occurred with a similar result. If this character should prove to have value, however, and if it can be connected with other characters, the remaining forms should be separated as variety *flaccida*. Plate IV represents the form published as *N. nemorensis*, which is the most common one about San Francisco bay, and which is taken as typical of the group of forms which make up the species.

It is perhaps worthy of note that the leaves which are least divided are most often alternate. This tendency is shown on very many specimens, and is extreme in the forms separated as *N. flaccida* and *N. inaequalis*.

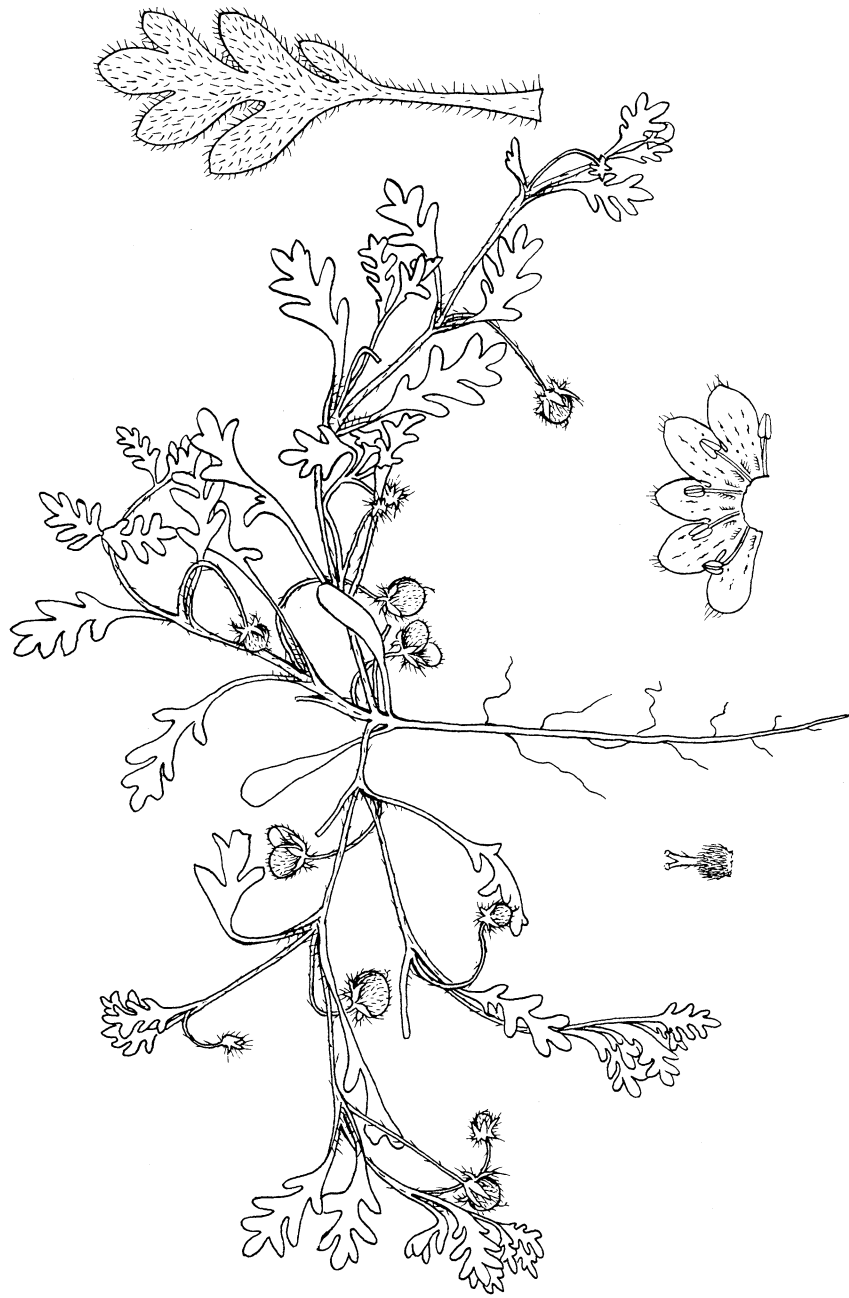
FROM SOUTHERN OREGON THROUGH NORTHERN AND CENTRAL CALIFORNIA.

*Specimens examined*: OREGON: Rogue river valley, *Howell*.

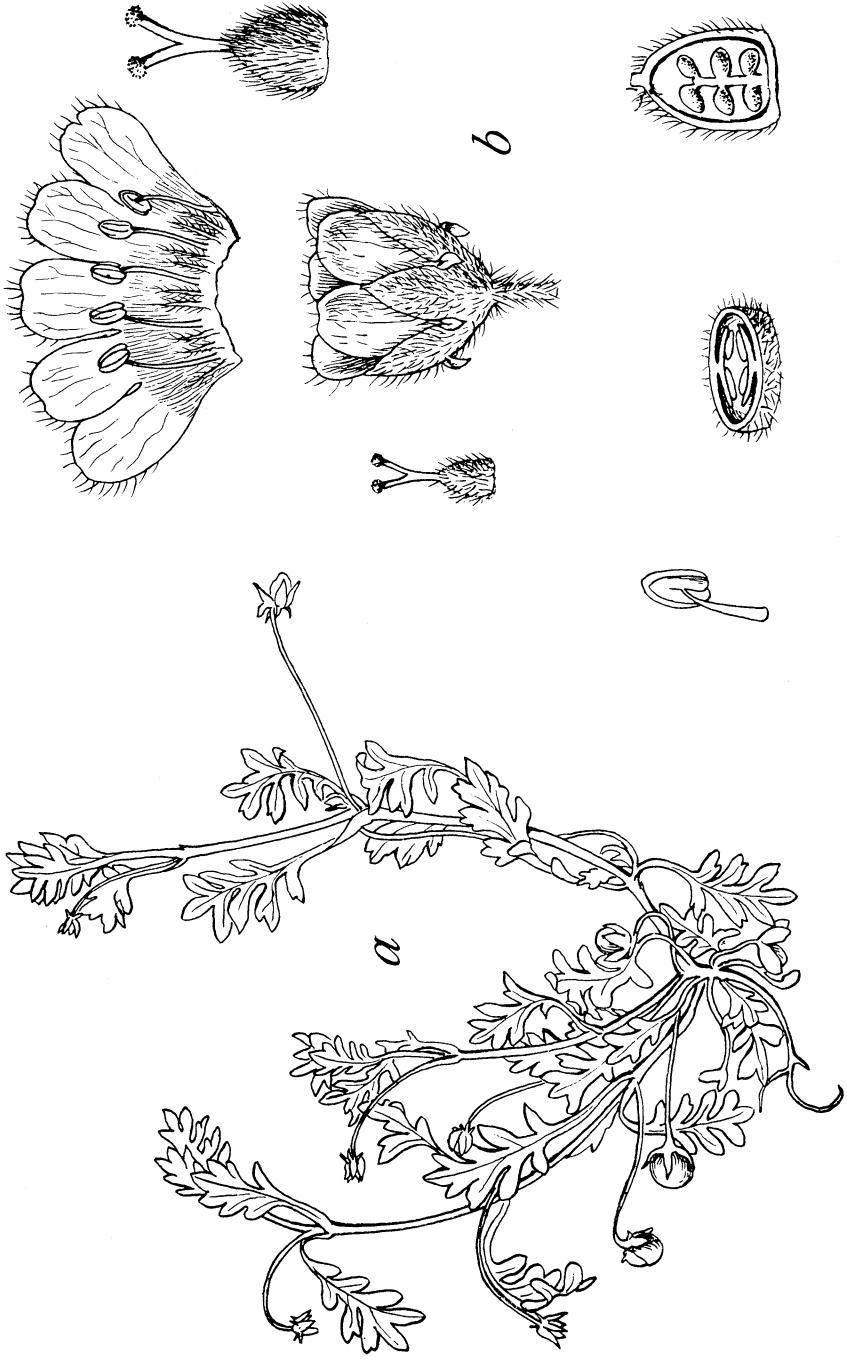
CALIFORNIA: Hupa, Humboldt co., *Mrs. Manning*; Mendocino co., *Bolander* no. 4647, *Brandegee*, *Chandler* nos. 1035 and 1065, *Eastwood*, *Purdy*, *Westerman*; Solano co., *Setchell*; Napa co., *Jepson*; Rutherford, *Chandler* no. 630; Sonoma co., *M. S. Baker*, *Bolander* nos. 3802 and 3811, *Samuels* no. 174; Windsor, *Mrs. Swett*; between Clear lake and Bartlett springs, *Eastwood* (type of *N. hispida*); Mt. St. Helena, *Eastwood* (type of *N. divaricata*); Russian river, *Brandegee* (type of *N. inaequalis*); Marin co., *Brewer* no. 938; Fairfax, *Eastwood* (type of *N. nemorensis*), *Michener & Bioletti*; Mt. Tamalpais, *Chandler* nos. 256, 768, etc., *Davy* no. 143, *Eastwood*, *Michener & Bioletti* etc.; Sausalito, *Kellogg & Harford* no. 785; Angel island, San Francisco bay, *Davy* no. 6885, *McLean*, *Michener & Bioletti*; Berkeley, *Chandler* nos. 554, 567, 1802, 1803, 1804, etc., *Davy* nos. 6920, 6922, etc., *Greene*, *Hall*, etc., and fresh material; Oakland, *Chestnut*, *Holder* no. 2589; Moraga valley, Contra Costa co., *Hall* no. 1625; Mt. Diablo, *Chandler* nos. 948, 949, and 985; Briones valley, Contra Costa co., *Chandler* nos. 580 and 580A; Antioch, *Davy* nos. 907 and 916; Martinez, *Chandler* no. 850; Stanford University, *Dudley*, *Rutter* no. 6; Loma Prieta mt., Santa Clara co., *Davy* no. 72a; Evergreen, Santa Clara co., *Davy* nos. 532 and 608; Pitt river, Shasta co., *Brown* no. 261 (type of *N. flaccida*); Iron cañon, Butte co., *Mrs. Austin* no. 272; Chico, *Winifred Paine*; Big Chico creek, *Austin* no. 2037 (types of both *N. glauca* and *N. fallax*); Stites, Colusa co., *Brandegee*; Applegate, Placer co., *Helen Smith* (type of *N. tenera*); Stockton, *Sanford*; Rose springs, Eldorado co., *Gates*; Amador co., *Hansen* nos. 1377 and 2064; Gwin mine, Calaveras co., *Jepson* no. 1785; Milton, Calaveras co., *Davy* no. 1390; Yosemite, *Bolander* no. 4820; Fresno, *Buckminster* (type of *N. gracilis*); Kaweah, *Hopping* no. 8; Grapevine spring, Tulare co., *Woolsey*; "California," *Bigelow* (*Whipple expedition*).

Type in the herbarium of the California Academy of Sciences, San Francisco; collected "on the Hog ranch road, Tuolumne count, California, by J. W. Congdon, June 9, 1897."

18. *N. EXILIS pulchella* (Eastwood) Chandler, comb. nov.—*N. pulchella* Eastwood, Bull. Torr. Bot. Club 28: 157. 1901.—Calyx-lobes linear, extending almost to the base; the appendages very minute or more often entirely wanting; corolla rotate-campanulate, mostly deep blue; scales linear, ciliate.



NEMOPHILA SEPULTA Parish



NEMOPHILA PEDUNCULATA Dougl.





NEMOPHILA PARVIFLORA Dougl.







NEMOPHILA EXILIS Eastwood



NEMOPHILA EXILIS Eastwood

## FOOTHILLS OF THE SOUTHERN SIERRA NEVADA.

*Specimens examined:* CALIFORNIA: Fresno co., *Eastwood*, *Eisen*; Sequoia park, *Jepson* no. 622; Kaweah, *Hopping* no. 37; Fraser's mill, Tulare co., (?) *Brandeggee*; Salt creek, Tulare co., *Eastwood* (type); Cramer, Tulare co., *Brandeggee*; Bear creek, Tulare co., *Purpus* no. 1720.

Type in the herbarium of the California Academy of Sciences, San Francisco; collected by Alice Eastwood on Salt creek, Tulare county, California.

UNIVERSITY OF CALIFORNIA.

## EXPLANATION OF PLATES II-V.

*Plate II. Nemophila sepulta* Parish.

Specimen from the type locality (Parish no. 4908); natural size.

*Plate III. Nemophila pedunculata* Dougl.

*A.* Portion of the type; natural size.

*B.* Analysis, drawn from a plant collected by Dr. Thomas Coulter in California (no. 480).

*Plate IV. Nemophila parviflora* Dougl.

*A.* Type specimen; three-fourths natural size.

*B.* Analysis, drawn from a specimen in the herbarium at Kew.

*Plate V. Nemophila exilis* Eastwood.

Specimen from Berkeley, California (typical of the species, of which the type specimen is regarded as an extreme form); natural size.